

Amendments to the Claims

Please cancel Claims 27 and 39. The Claim Listing below will replace all prior versions of the claims in the application.

1-19. (Cancelled)

20. (Previously presented) A proton-conducting polymer membrane which is based on polyvinylsulphonic acid and is obtained by a process comprising the steps of:

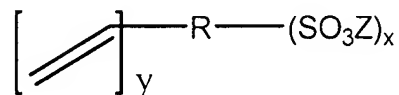
- a) mixing a polymer with a vinyl-containing sulphonic acid,
- b) forming a flat structure using the mixture from step a) on a support,
- c) polymerizing the vinyl-containing sulphonic acid present in the flat structure from step b),

characterized in that the membrane has an intrinsic conductivity of at least 0.001 S/cm.

21. (Previously presented) The membrane of Claim 20, characterized in that the polymer used in step a) is a high-temperature-stable polymer containing at least one nitrogen, oxygen, or sulphur atom in one repeating unit or in different repeating units.

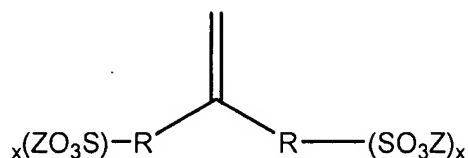
22. (Previously presented) The membrane of Claim 20, characterized in that one or more polyazoles and/or polysulphones are used in step a).

23. (Previously presented) The membrane of Claim 20, characterized in that the mixture prepared in step a) contains compounds of the formula



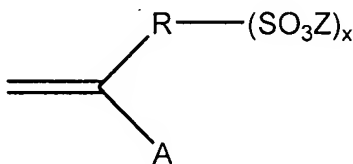
where

- R is a bond, a C1-C15 alkyl group, C1-C15 alkoxy group, ethylenoxy group or C5-C20 aryl or heteroaryl group, with the above radicals optionally substituted by halogen, -OH, COOZ, -CN, or NZ₂,
- Z are each, independently of one another, hydrogen, a C1-C15 alkyl group, C1-C15 alkoxy group, ethylenoxy group or C5-C20 aryl or heteroaryl group, with the above radicals optionally substituted by halogen, -OH, -CN,
- x is 1, 2, 3, 4, 5, 6, 7, 8, 9 or 10, and
- y is 1, 2, 3, 4, 5, 6, 7, 8, 9 or 10, or
- the formula



where

- R is a bond, a C1-C15 alkyl group, C1-C15 alkoxy group, ethylenoxy group or C5-C20 aryl or heteroaryl group, with the above radicals optionally substituted by halogen, -OH, COOZ, -CN, NZ₂,
- Z are each, independently of one another, hydrogen, a C1-C15 alkyl group, C1-C15 alkoxy group, ethylenoxy group or C5-C20 aryl or heteroaryl group, with the above radicals optionally substituted by halogen, -OH, -CN, and
- x is 1, 2, 3, 4, 5, 6, 7, 8, 9 or 10, or
- the formula



where.

- A is a group of the formula COOR², CN, CONR₂², OR², or R², where R² is hydrogen, a C1-C15 alkyl group, C1-C15 alkoxy group, ethylenoxy group or C5-

C20 aryl or heteroaryl group, with the above radicals optionally substituted by halogen, -OH, COOZ, -CN, NZ₂,

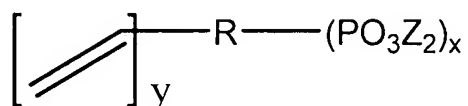
R is a bond, a divalent C1-C15 alkylene group, divalent C1-C15 alkyleneoxy group, or a divalent C5-C20 aryl or heteroaryl group, with the above radicals optionally substituted by halogen, -OH, COOZ, -CN, NZ₂,

Z are each, independently of one another, hydrogen, a C1-C15 alkyl group, C1-C15 alkoxy group, ethyleneoxy group or C5-C20 aryl or heteroaryl group, with the above radicals optionally substituted by halogen, -OH, -CN, and

x is 1, 2, 3, 4, 5, 6, 7, 8, 9 or 10.

24. (Previously presented) The membrane of Claim 20, characterized in that the mixture prepared in step a) comprises vinyl-containing phosphonic acid.

25. (Previously presented) The membrane of Claim 24, characterized in that the mixture prepared in step a) contains compounds of the formula



where

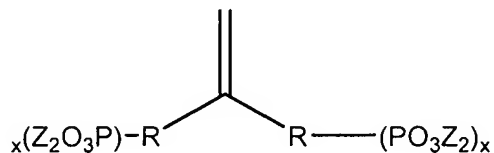
R is a bond, a C1-C15 alkyl group, C1-C15 alkoxy group, ethyleneoxy group or C5-C20 aryl or heteroaryl group, with the above radicals optionally substituted by halogen, -OH, COOZ, -CN, NZ₂,

Z are each, independently of one another, hydrogen, a C1-C15 alkyl group, C1-C15 alkoxy group, ethyleneoxy group or C5-C20 aryl or heteroaryl group, with the above radicals optionally substituted by halogen, -OH, -CN,

x is 1, 2, 3, 4, 5, 6, 7, 8, 9 or 10, and

y is 1, 2, 3, 4, 5, 6, 7, 8, 9 or 10, or

the formula



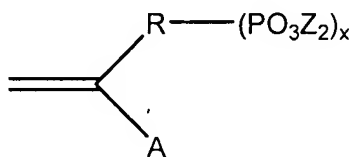
where

R is a bond, a C1-C15 alkyl group, C1-C15 alkoxy group, ethylenoxy group or C5-C20 aryl or heteroaryl group, with the above radicals optionally substituted by halogen, -OH, COOZ, -CN, NZ₂,

Z are each, independently of one another, hydrogen, a C1-C15 alkyl group, C1-C15 alkoxy group, ethylenoxy group or C5-C20 aryl or heteroaryl group, with the above radicals optionally substituted by halogen, -OH, -CN, and

x is 1, 2, 3, 4, 5, 6, 7, 8, 9 or 10, or

the formula



where

A is a group of the formula COOR², CN, CONR²₂, OR², or R², where R² is hydrogen, a C1-C15 alkyl group, C1-C15 alkoxy group, ethylenoxy group, or C5-C20 aryl or heteroaryl group, with the above radicals optionally substituted by halogen, -OH, COOZ, -CN, NZ₂,

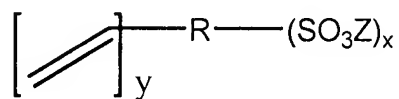
R is a bond, a divalent C1-C15 alkylene group, divalent C1-C15 alkyleneoxy group, or a divalent C5-C20 aryl or heteroaryl group, with the above radicals optionally substituted by halogen, -OH, COOZ, -CN, NZ₂,

Z are each, independently of one another, hydrogen, a C1-C15 alkyl group, C1-C15 alkoxy group, ethyleneoxy group or C5-C20 aryl or heteroaryl group, with the above radicals optionally substituted by halogen, -OH, -CN, and

x is 1, 2, 3, 4, 5, 6, 7, 8, 9 or 10.

26. (Previously presented) The membrane of Claim 24, characterized in that the weight ratio of vinyl-containing phosphonic acid to vinyl-containing sulphonic acid is in the range from 1:100 to 99:1.

27. (Cancelled)
28. (Previously presented) The membrane of Claim 20, characterized in that the polymerization in step c) is effected by means of a substance which is capable of forming free radicals.
29. (Previously presented) The membrane of Claim 20, characterized in that the polymerization in step c) is carried out by irradiation with IR light, NIR light, UV light, β -rays, γ -rays, or electron beams.
30. (Previously presented) The membrane of Claim 20, characterized in that the membrane comprises from 1 to 90% by weight of the polymer and from 99 to 0.5% by weight of polyvinylsulphonic acid.
31. (Previously presented) The membrane of Claim 20, characterized in that the membrane has a layer comprising a catalytically active component.
32. (Withdrawn) A mixture comprising:
a vinyl-containing sulphonic acid having the formula



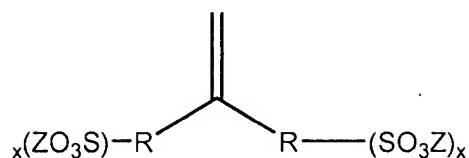
where

R is a bond, a C1-C15 alkyl group, C1-C15 alkoxy group, ethylenoxy group or C5-C20 aryl or heteroaryl group, with the above radicalations optionally substituted by halogen, -OH, COOZ, -CN, or NZ₂,

Z are each, independently of one another, hydrogen, a C1-C15 alkyl group, C1-C15 alkoxy group, ethylenoxy group or C5-C20 aryl or heteroaryl group, with the above radicals optionally substituted by halogen, -OH, -CN,

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x is 1, 2, 3, 4, 5, 6, 7, 8, 9 or 10, and
 y is 1, 2, 3, 4, 5, 6, 7, 8, 9 or 10, or
 the formula

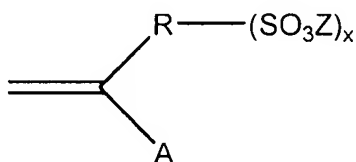


where

R is a bond, a C1-C15 alkyl group, C1-C15 alkoxy group, ethylenoxy group or C5-C20 aryl or heteroaryl group, with the above radicals optionally substituted by halogen, -OH, COOZ, -CN, NZ₂,

Z are each, independently of one another, hydrogen, a C1-C15 alkyl group, C1-C15 alkoxy group, ethylenoxy group or C5-C20 aryl or heteroaryl group, with the above radicals optionally substituted by halogen, -OH, -CN, and

x is 1, 2, 3, 4, 5, 6, 7, 8, 9 or 10, or
 the formula



where

A is a group of the formula COOR², CN, CONR²₂, OR², or R², where R² is hydrogen, a C1-C15 alkyl group, C1-C15 alkoxy group, ethylenoxy group or C5-C20 aryl or heteroaryl group, with the above radicals optionally substituted by halogen, -OH, COOZ, -CN, NZ₂,

R is a bond, a divalent C1-C15 alkylene group, divalent C1-C15 alkyleneoxy group, or a divalent C5-C20 aryl or heteroaryl group, with the above radicals optionally substituted by halogen, -OH, COOZ, -CN, NZ₂,

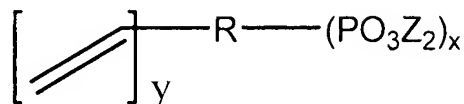
Z are each, independently of one another, hydrogen, a C1-C15 alkyl group, C1-C15 alkoxy group, ethylenoxy group or C5-C20 aryl or heteroaryl group, with the above radicals optionally substituted by halogen, -OH, -CN, and

x is 1, 2, 3, 4, 5, 6, 7, 8, 9 or 10; and

at least one polymer which has a solubility of at least 1% by weight in the vinyl-containing sulphonic acid.

33. (Withdrawn) The mixture of Claim 32, characterized in that the polymer used contains at least one nitrogen, oxygen, or sulphur atom in one repeating unit or in different repeating units.
34. (Withdrawn) The mixture of Claim 32, characterized in that it contains at least one monomer capable of crosslinking.
35. (Withdrawn) The mixture of Claim 32, characterized in that it contains at least one initiator which is capable of forming free radicals.
36. (Withdrawn) The mixture of Claim 32, characterized in that the mixture comprises at least one vinyl-containing phosphonic acid.
37. (Withdrawn) A membrane-electrode unit containing at least proton-conducting polymer membrane which is based on polyvinylsulphonic acid and is obtained by a process comprising the steps of:
 - a) mixing a polymer with a vinyl-containing sulphonic acid,
 - b) forming a flat structure using the mixture from step a) on a support,
 - c) polymerizing the vinyl-containing sulphonic acid present in the flat structure from step b),characterized in that the membrane has an intrinsic conductivity of at least 0.001 S/cm.

38. (Withdrawn) The unit of Claim 37, characterized in that the mixture prepared in step a) contains compounds of the formula



where

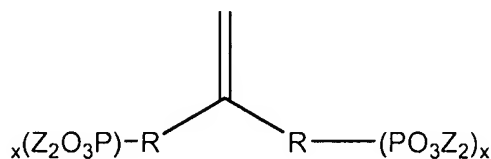
R is a bond, a C1-C15 alkyl group, C1-C15 alkoxy group, ethylenoxy group or C5-C20 aryl or heteroaryl group, with the above radicals optionally substituted by halogen, -OH, COOZ, -CN, NZ₂,

Z are each, independently of one another, hydrogen, a C1-C15 alkyl group, C1-C15 alkoxy group, ethylenoxy group or C5-C20 aryl or heteroaryl group, with the above radicals optionally substituted by halogen, -OH, -CN,

x is 1, 2, 3, 4, 5, 6, 7, 8, 9 or 10, and

y is 1, 2, 3, 4, 5, 6, 7, 8, 9 or 10, or

the formula



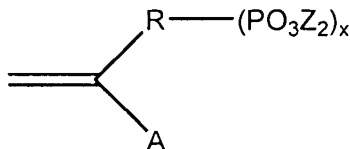
where

R is a bond, a C1-C15 alkyl group, C1-C15 alkoxy group, ethylenoxy group or C5-C20 aryl or heteroaryl group, with the above radicals optionally substituted by halogen, -OH, COOZ, -CN, NZ₂,

Z are each, independently of one another, hydrogen, a C1-C15 alkyl group, C1-C15 alkoxy group, ethylenoxy group or C5-C20 aryl or heteroaryl group, with the above radicals optionally substituted by halogen, -OH, -CN, and

x is 1, 2, 3, 4, 5, 6, 7, 8, 9 or 10, or

the formula



where

- A is a group of the formula COOR^2 , CN , CONR_2^2 , OR^2 , or R^2 , where R^2 is hydrogen, a C1-C15 alkyl group, C1-C15 alkoxy group, ethylenoxy group, or C5-C20 aryl or heteroaryl group, with the above radicals optionally substituted by halogen, -OH, COOZ , -CN, NZ_2 ,
- R is a bond, a divalent C1-C15 alkylene group, divalent C1-C15 alkyleneoxy group, or a divalent C5-C20 aryl or heteroaryl group, with the above radicals optionally substituted by halogen, -OH, COOZ , -CN, NZ_2 ,
- Z are each, independently of one another, hydrogen, a C1-C15 alkyl group, C1-C15 alkoxy group, ethyleneoxy group or C5-C20 aryl or heteroaryl group, with the above radicals optionally substituted by halogen, -OH, -CN, and
- x is 1, 2, 3, 4, 5, 6, 7, 8, 9 or 10.

39. (Cancelled)

40. (Withdrawn) A fuel cell containing:

one or more membrane-electrode units containing at least one proton-conducting polymer membrane which is based on polyvinylsulphonic acid and is obtained by a process comprising the steps of:

- a) mixing a polymer with a vinyl-containing sulphonic acid,
- b) forming a flat structure using the mixture from step a) on a support,
- c) polymerizing the vinyl-containing sulphonic acid present in the flat structure from step b),

characterized in that the membrane has an intrinsic conductivity of at least 0.001 S/cm, or one or more of the proton-conducting polymer membranes.